

# Bonding of Asphalt Pavement Layers



at AUBURN UNIVERSITY



# Slip on 2003 Track

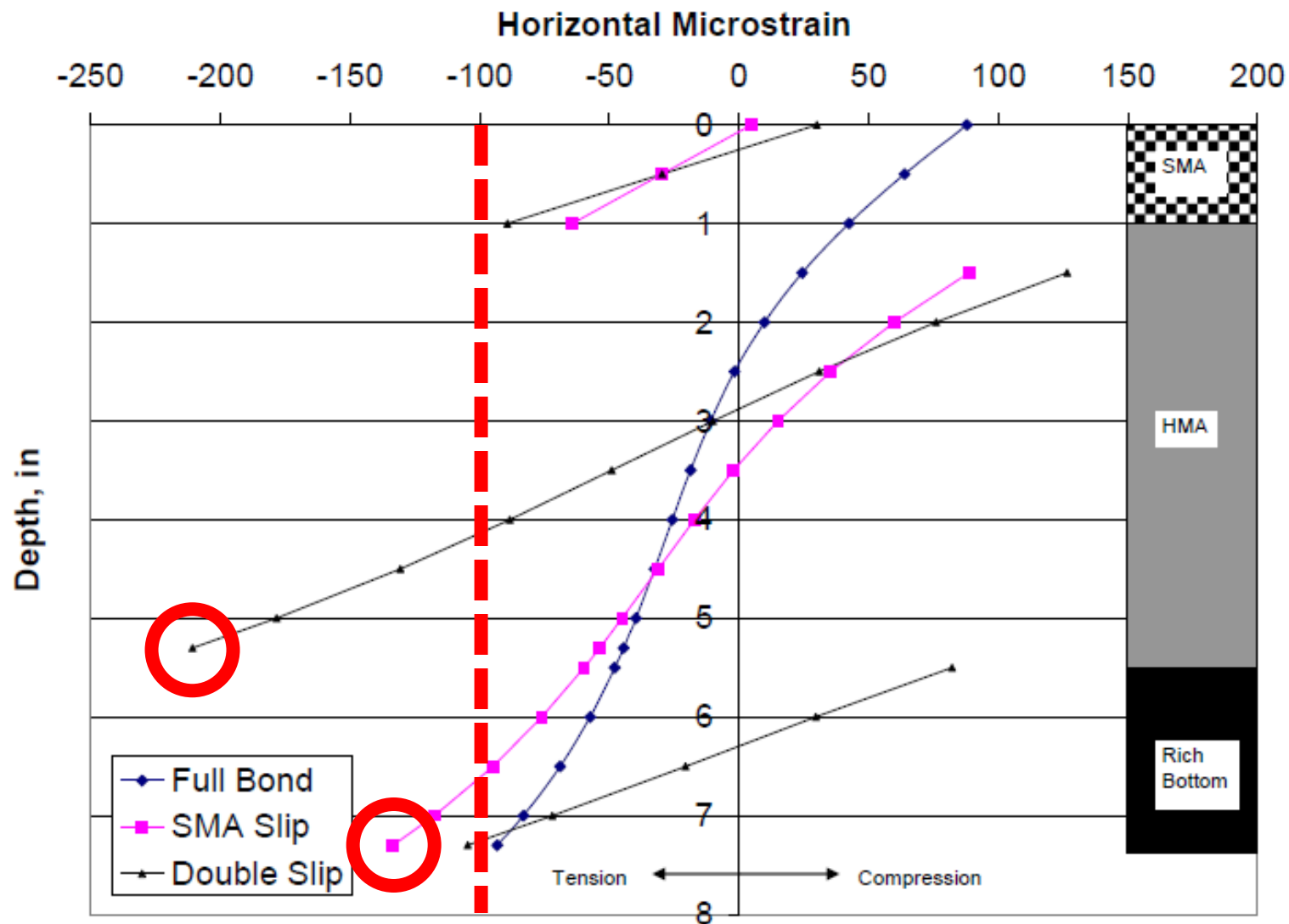




# Content

- Why worry about bond strength?
- How can you measure bond quality?
- Comprehensive study (lab vs field)
- Results from 2009 & 2012 Tracks
- Conclusions & recommendations

# Impact of Slip on M-E Response<sub>12-04</sub>

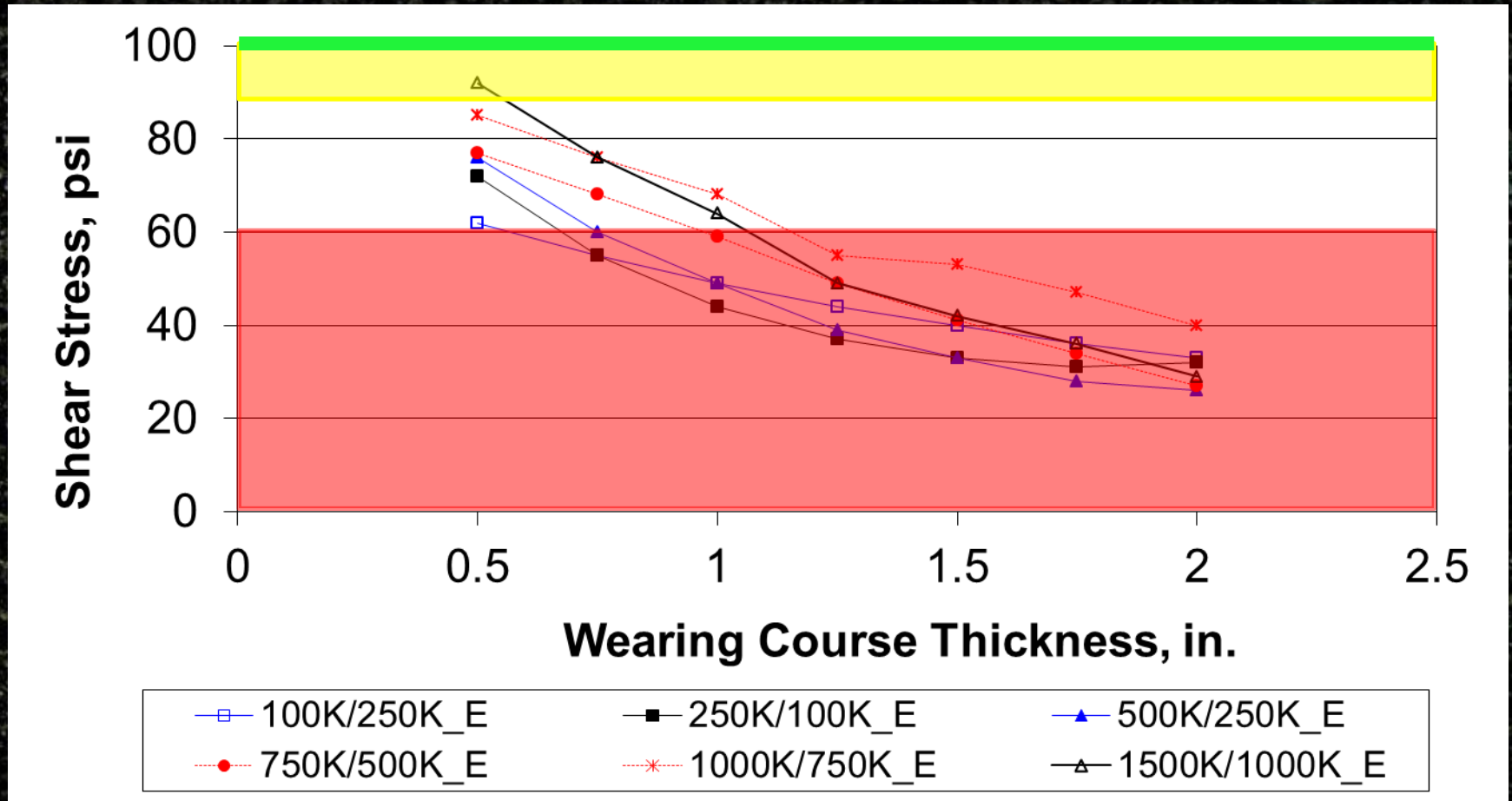




# Measuring Bond Strength



# M-E Predictions + Field Measurements

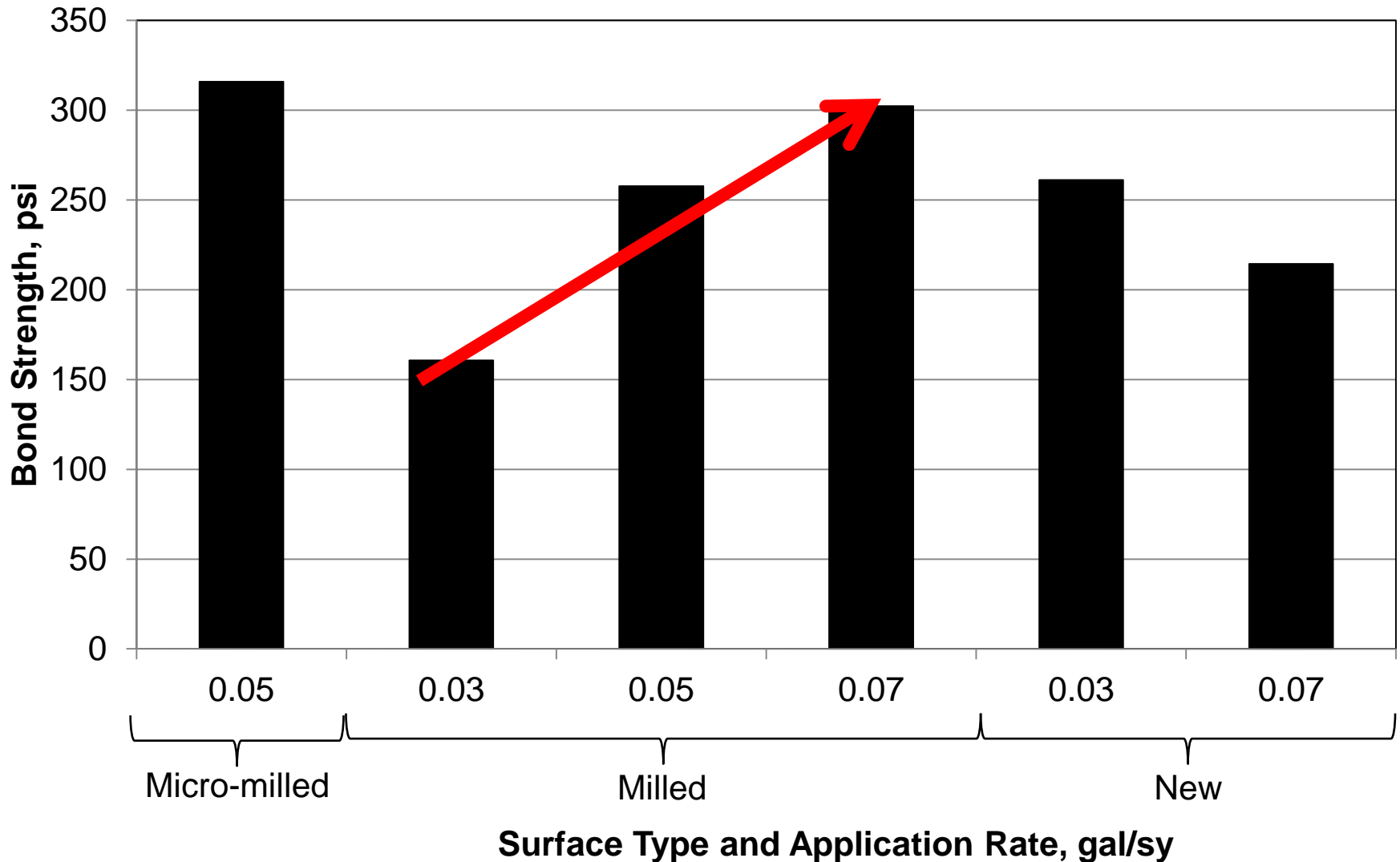




# Comprehensive Tack Study Design

- Results from both laboratory<sub>37/222</sub> & field<sub>123/369</sub>
- New, milled, and micro milled surfaces
- Representative products and practical rates
  - PG67-22 at 0.03, 0.05, 0.07 gal/yd<sup>2</sup>
  - NTSS-1HM at 0.04, 0.06, 0.08 gal/yd<sup>2</sup>
  - CRS-2, CRS-2L, CQS-1h at 0.05, 0.075, 0.10 gal/yd<sup>2</sup>

# Lab Results for PG67-22



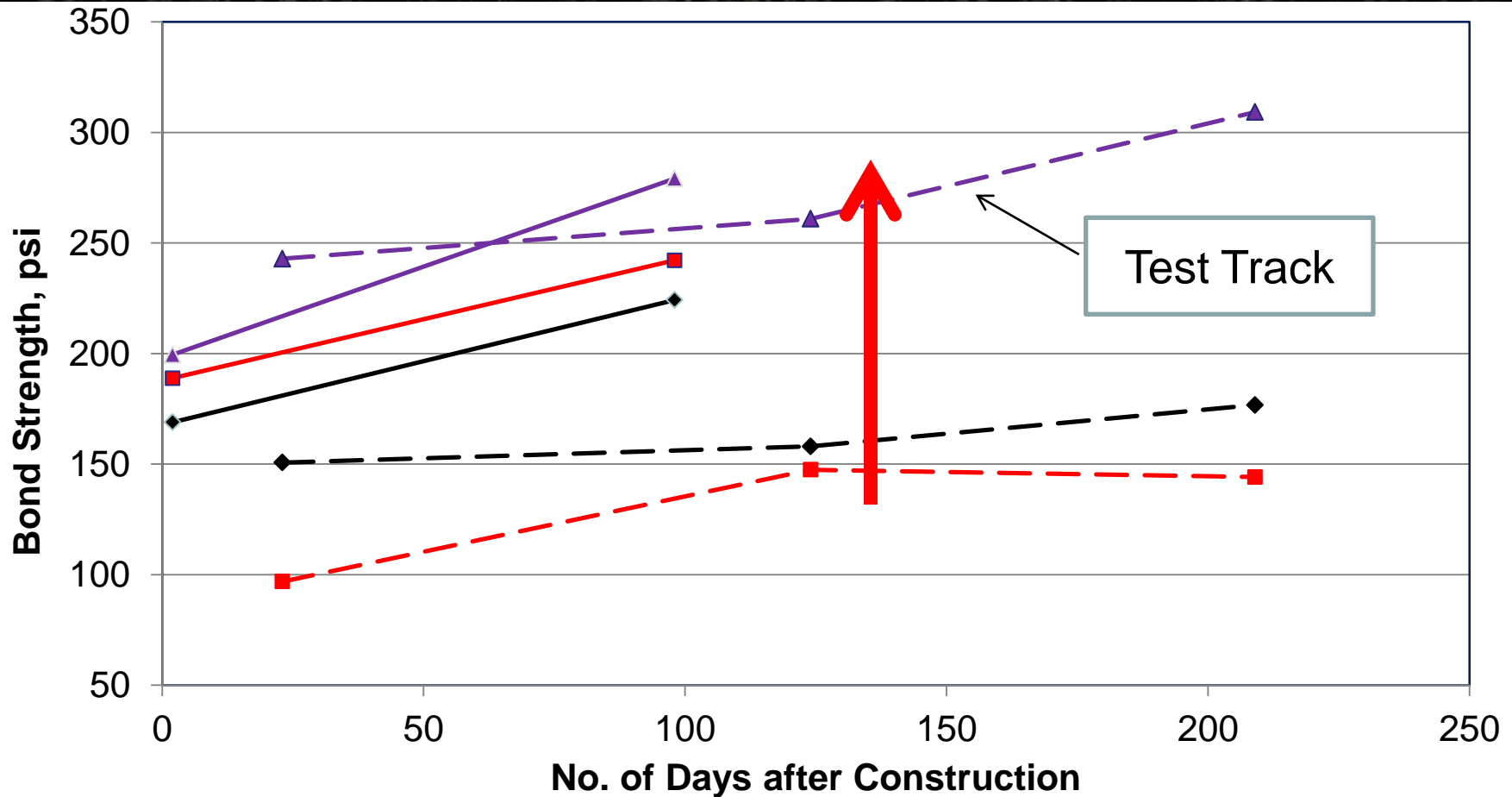


# Field Rate Measurements





# Field Results for PG67-22



—◆— 0.0246 gal/sy & existing  
-◆- 0.025 gal/sy & milled

—■— 0.0473 gal/sy & existing  
-■- 0.0348 gal/sy & milled

—▲— 0.0625 gal/sy & existing  
-▲- 0.0639 gal/sy & milled



# Comprehensive Tack Study Findings

- Results from both laboratory and field
  - Laboratory bond strengths higher than field
- New, milled, and micro milled surfaces
  - Milling and micro milling improves bond in lab
  - Debris necessitates higher rate (x2) in field
- Representative products and rates
  - Bond develops quicker for PG67-22 & NTSS-1HM
  - Traffic does not increase bond strength



# NCAT Pavement Test Track





# Wheelpath Pickup





# Spray Paver on 2009 Track

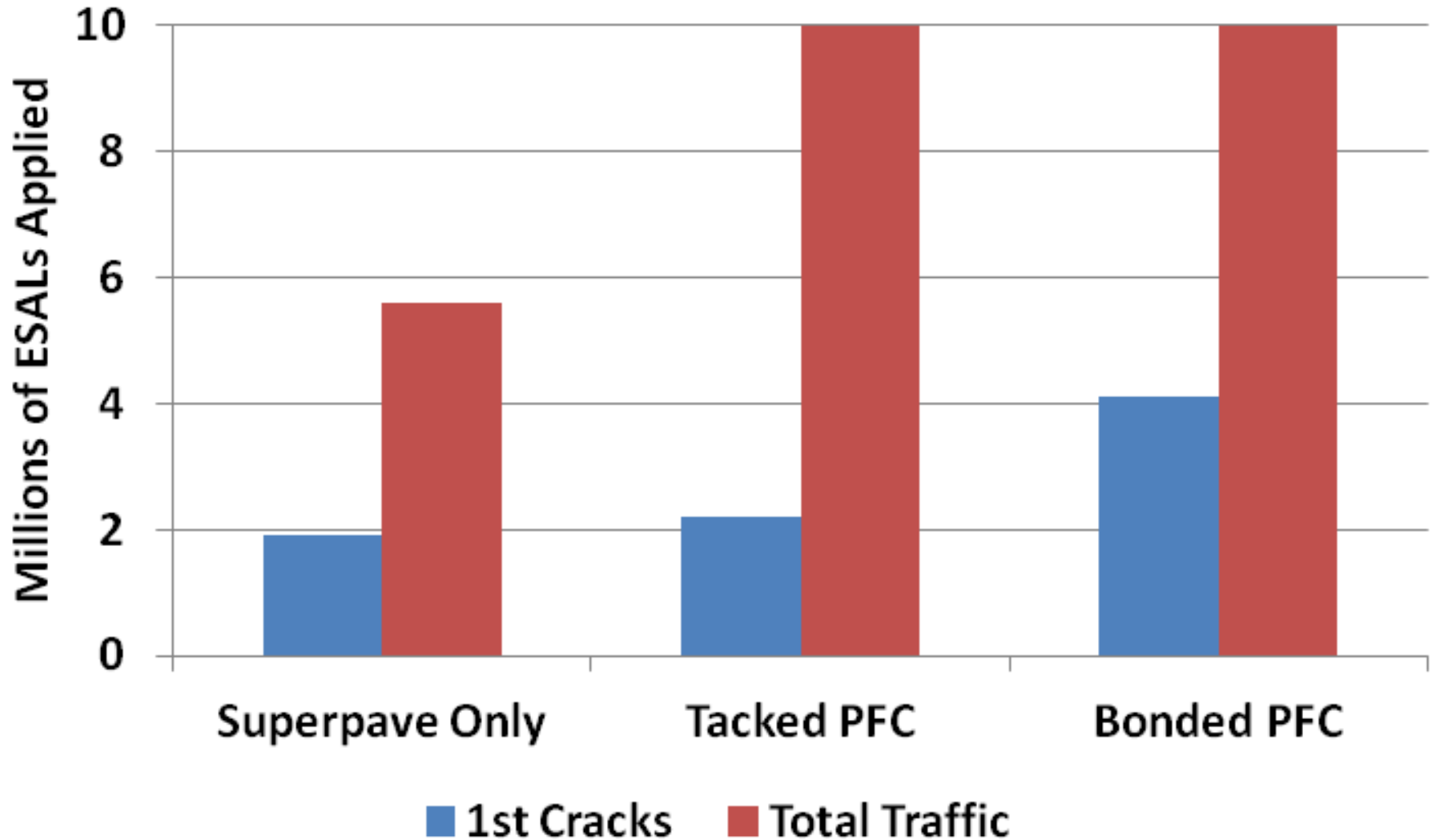




# Spray Paver (Top) vs Conventional



# 2009 Tack Study Results





# 2012 Tack Coat Study



← N1A eTac 0.10/0.06

← N1B UltraFuse 0.15/0.15

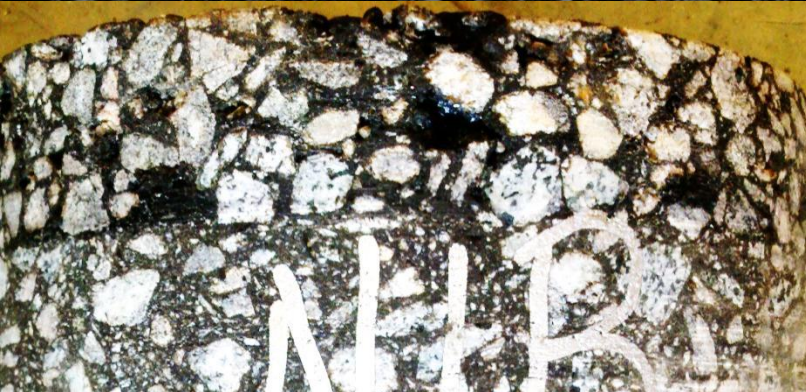
← N2 Trackless 0.05/0.03



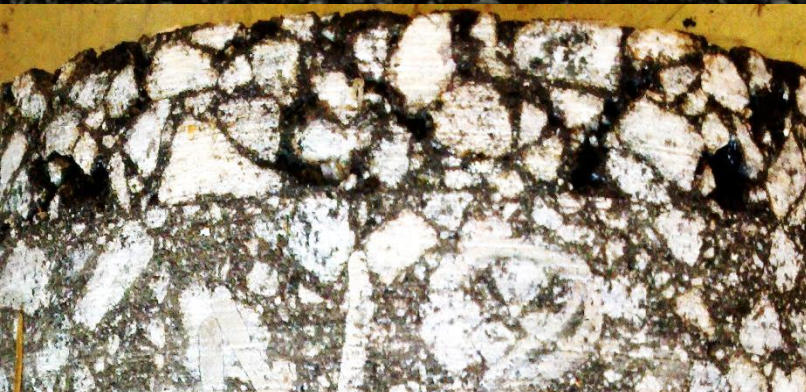
# 2012 Tack Coat Study



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← N1B UltraFuse 0.15/0.15



← N2 Trackless 0.05/0.03

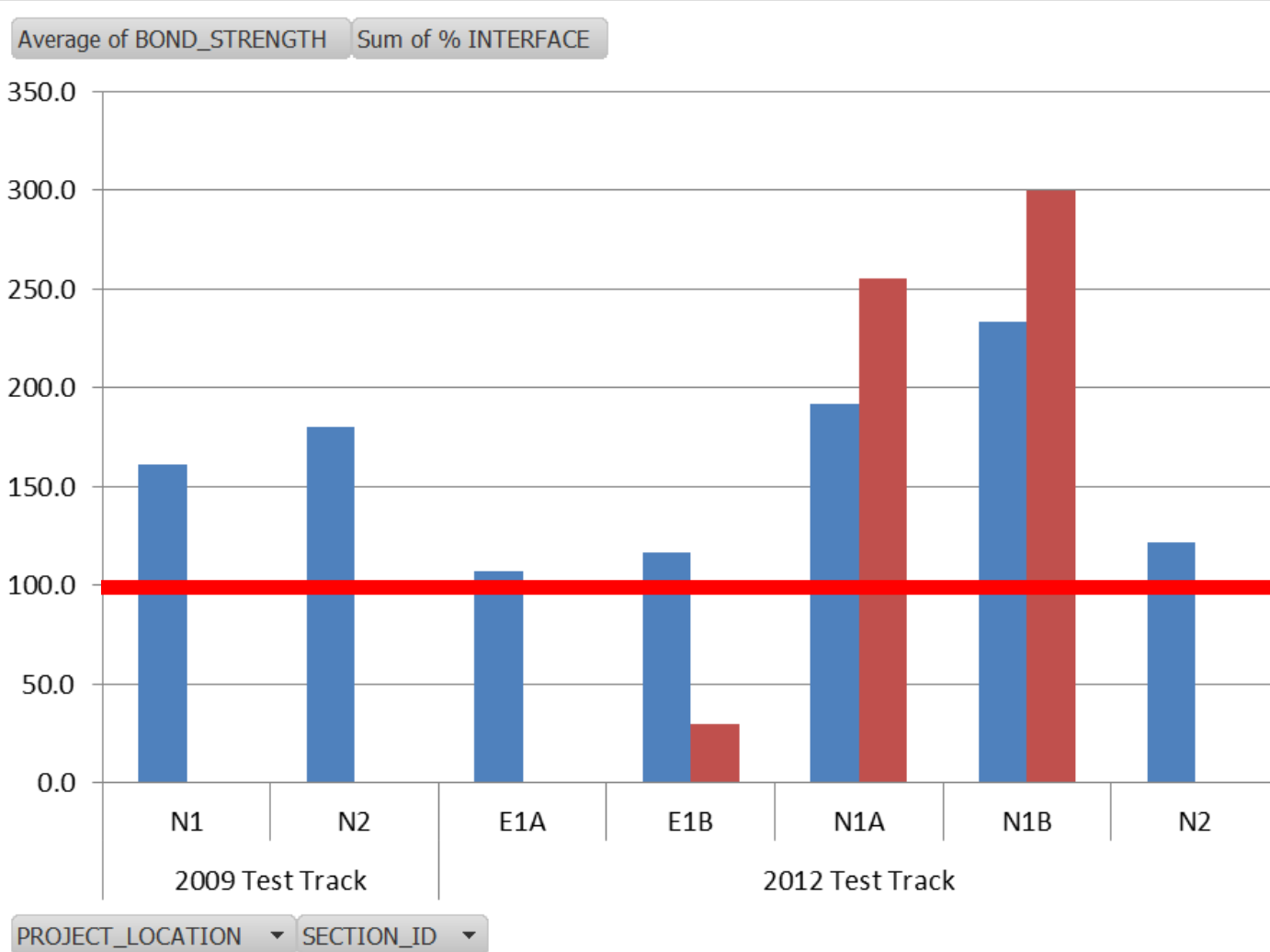


# 2012 Tack Coat Study





# 2012 Tack Coat Study



Values

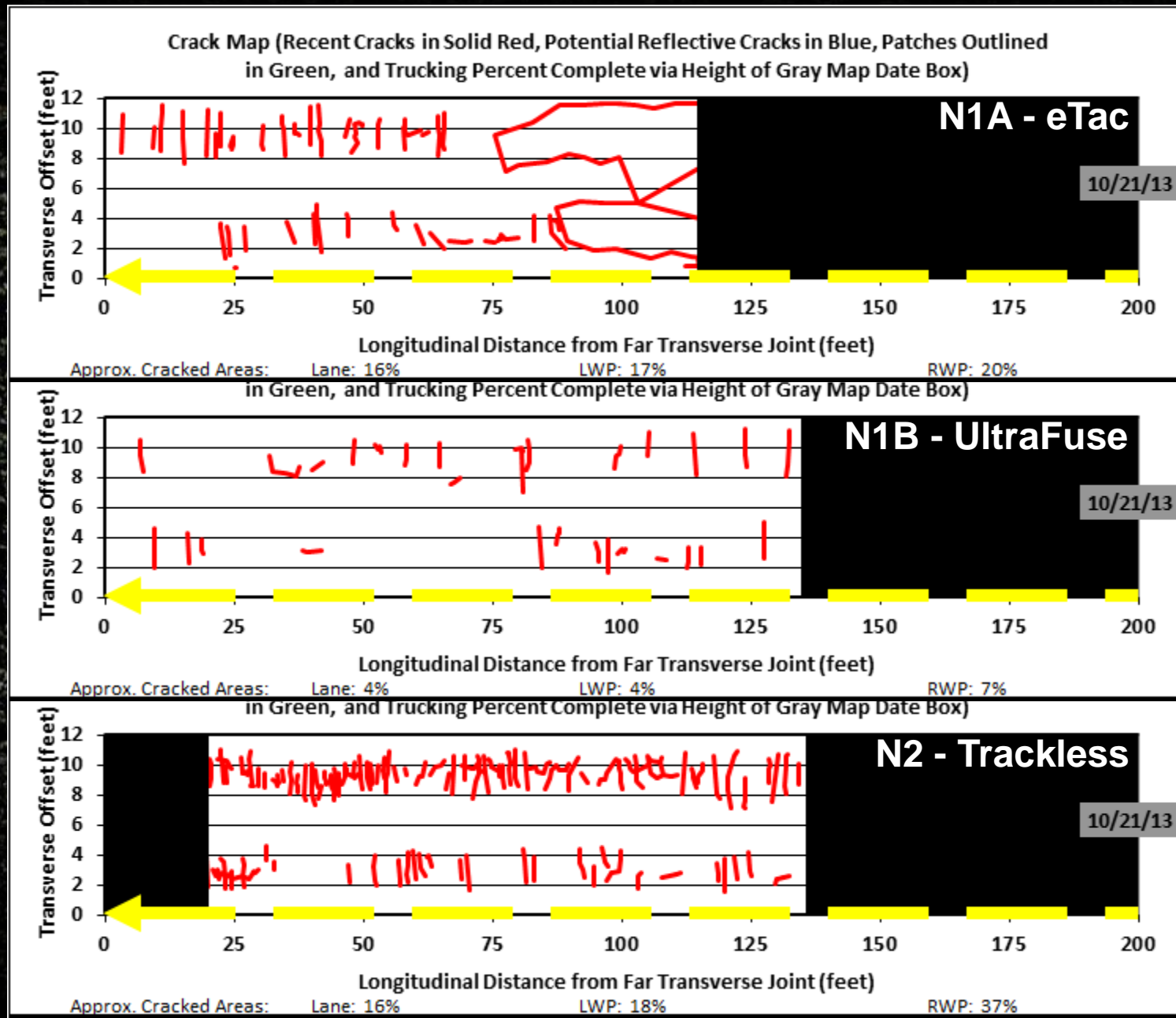
■ Average of BOND\_STRENGTH

■ Sum of % INTERFACE





# FDOT Tack Coat for PFCs





# Bottom Line for Asphalt Layer Bonding

- 100 psi minimum bond strength
- PG67-22
  - 0.03 to 0.07 gal/yd<sup>2</sup> on new pavement
  - 0.05 to 0.09 gal/yd<sup>2</sup> on milled surface
- NTSS-1HM (undiluted bar rates)
  - 0.04 to 0.08 gal/yd<sup>2</sup> on new pavement
  - 0.06 to 0.10 gal/yd<sup>2</sup> on milled surface
- CQS-1H and CRS-2 (undiluted bar rates)
  - 0.05 to 0.10 gal/yd<sup>2</sup> on all surfaces
- High end for higher RAP/RAS mixes!



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# Evolution of Cracking in GG RAP Section



1. Weak bond between binder and base layers
2. Debonding between binder and base layers
3. "Middle-up" crack initiated at bottom of binder
4. "Middle-up" crack reaches surface of pavement
5. Full depth crack extends to bottom of base



# Questions ?



**Report 12-04**

[www.ncat.us](http://www.ncat.us)

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